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Gait Retraining with Real-time Biofeedback for Reducing the Knee Adduction Moment in People with Medial Knee Osteoarthritis

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About the author

SUMMARY

Rosie Richards was born in Brecon, Wales on September 7th 1987. After completing her A Levels at Gwernyfed High School in Powys, Rosie studied Medical Engineering at Cardiff University. It was here that she became interested in the use of motion capture to study the movement of the human body. During her studies Rosie took a year in industry, working at Gyrus Medical in Cardiff, to experience life in the commercial sector and gain some practical skills. After completing her Bachelor's degree with a First, Rosie moved to London where she worked as a Trainee Clinical Scientist within the NHS, whilst also completing a MSc at University College London in Medical Physics and Engineering. Thereafter, she decided to specialise in evaluation of biomechanical function, working in the gait lab at the Royal National Orthopaedic Hospital in Stanmore, London. In early 2015 Rosie moved to Amsterdam to start her PhD research at the Vrij Universiteit medisch centrum (VUmc) under Prof. J. Harlaar, the results of which are published in this thesis.

Publications

Accepted Publications

- Richards R**, Andersen M S, Harlaar J, van den Noort J. Relationship between knee joint contact forces and external knee joint moments in patients with medial knee osteoarthritis: effects of gait modifications. *Osteoarthritis and Cartilage*. 2018. DOI: 10.1016/j.joca.2018.04.011
- Richards R**, van den Noort JC, Booij MJ, van der Esch M, Harlaar J. Gait retraining using real-time feedback in patients with medial knee osteoarthritis: feasibility and effects of a six-week gait training program. *The Knee* 2018 (In press)
- Cudejko T, Van der Esch M, Schrijvers J, **Richards R**, Van den Noort JC, Wrigley T, van der Leeden M, et al. The immediate effect of a soft knee brace on dynamic knee instability in persons with knee osteoarthritis. *Rheumatology* 2018; (In press)
- Richards R**, van der Esch M, van den Noort JC, Harlaar J. The learning process of gait retraining using real-time feedback in patients with medial knee osteoarthritis. *Gait Posture* 2018 23; 62:1-6. DOI: 10.1016/j.gaitpost.2018.02.023
- Richards R**, van den Noort JC, van der Esch M, Booij MJ, Harlaar J. Effect of real-time biofeedback on peak knee adduction moment in patients with medial knee osteoarthritis: is direct feedback effective? *Clin Biomech* (Bristol, Avon). 2017 Jul 13. DOI: 10.1016/j.clinbiomech.2017.07.004
- Richards R**, van den Noort JC, Dekker J, Harlaar J. Gait retraining with real-time biofeedback to reduce knee adduction moment: Systematic review of effects and methods used. *Arch Phys Med Rehabil*. 2016 Jul 3. DOI: 10.1016/j.apmr.2016.07.006
- Wyatt HL, **Richards R**, Pullin R, Yang THJ, Blain EJ, Evans SL. Variation In Electrosurgical Vessel Seal Quality Along The Length Of A Porcine Carotid Artery. *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine* 2016. Vol 230, Issue 3, pp. 169 – 174 DOI: 10.1177/0954411915621092
- Richards R.**, Allen J., Howell KJ., Smith RE. Evaluation of three thermal imaging cameras for skin temperature measurements using a blackbody reference source and a spatial resolution test object. *Thermology International* 23:17 – 23

Submitted Publications

- Karatsidis A., **Richards R.**, Konrath J., van den Noort JC., Schepers HM., Bellusci G., Harlaar J., Veltink PH. Validation of wearable visual feedback for retraining foot progression angle using inertial sensors and an augmented reality headset. *Journal of NeuroEngineering and Rehabilitatin* (Under review)
- Heine M, **Richards R.**, Geurtz B., Los F., Rietberg M., Harlaar J., Gerrits K., Beckerman H., de Groot V. Preliminary effectiveness of a sequential exercise intervention on gait function in ambulant patients with MS - a pilot study. *Physiotherapy* (Under review)

CONFERENCE ABSTRACTS

International Conferences

Presenting author

- Richards R.**, van den Noort JC., van der Esch M., Booij MJ., Harlaar J. Short and longer term effects of a toe in gait retraining program in people with medial knee osteoarthritis. Poster presentation at Osteoarthritis Research Society International Congress (OARSI) 2018. Osteoarthritis and Cartilage 26: S340 DOI: 10.1016/j.joca.2018.02.674
- Richards R.**, Booij MJ., van der Esch M., van den Noort JC., Harlaar J. Gait modifications in knee osteoarthritis patients: estimating the learning effect. Podium presentation at International Society of Biomechanics 2017.
- Richards R.**, Heine M., Geurtz B., Los F., Rietberg M., Harlaar J., Gerrits K., Beckerman H., de Groot V. Changes in ankle power generation following resistance and endurance training in multiple sclerosis. Poster presentation at International Society of Biomechanics 2017.
- Richards R.**, Booij MJ., van der Esch M., van den Noort JC., Harlaar J. Gait retraining in patients with knee osteoarthritis: effect of dual-tasking on ability to walk with modified gait pattern. Poster presentation at European Forum for Research in Rehabilitation 2017.

Richards R., van den Noort JC., Booij MJ., Harlaar J. Real-time feedback for gait retraining in knee osteoarthritis: Responses to different types of feedback and instructions. Podium presentation at ESMAC 2016. Gait & Posture 49. DOI: 10.1016/j.gaitpost.2016.07.131

Richards R., van den Noort JC., Dekker J., Harlaar J. Effects of gait retraining with real-time biofeedback in patients with knee osteoarthritis: systematic review and meta-analysis. Poster presentation at OARSI 2016. Osteoarthritis and Cartilage 24(1): S470 DOI: 10.1016/j.joca.2016.01.858

Richards R., Cohen H., McCarthy I. Dynamic stability in patients with joint hypermobility syndrome during steady state treadmill walking. Poster presentation at ESMAC 2015. Gait & Posture 42 DOI: 10.1016/j.gaitpost.2015.06.078

Richards R., Thornton MT., Delaney RMR., EMG variance ratio – A useful clinical outcome measure? Podium presentation at ESMAC 2014. Gait & Posture DOI: 10.1016/j.gaitpost.2014.04.111

Other author

Schrijvers J., Rutherford D., **Richards R.**, van den Noort JC., van der Esch M., Harlaar J. Inter-laboratory comparison of gait waveforms in individuals with knee osteoarthritis Poster presentation at OARSI 2018. Osteoarthritis and Cartilage 26: S372 DOI: 10.1016/j.joca.2018.02.732

Cudejko T., van der Esch M., Schrijvers J., **Richards R.**, van den Noort J., Wrigley TV., van der Leeden M., Roorda LD., Lems W., Harlaar J., Dekker J. The immediate effect of a soft knee brace on dynamic knee instability during perturbed walking in persons with knee osteoarthritis. Poster presentation at OARSI 2018. Osteoarthritis and Cartilage 26:S363-S364 DOI: 10.1016/j.joca.2018.02.720

Richards R., van den Noort JC, van der Esch M, Booij MJ, Harlaar J. Feedback for gait retraining in medial knee osteoarthritis; direct or indirect feedback? Poster presentation at OARSI, Las Vegas 2017. Osteoarthritis and Cartilage 25(1):S117 DOI: 10.1016/j.joca.2017.02.187

Booij MJ., **Richards R.**, Harlaar J., Rutherford D., van den Noort, J. Knee muscle activation patterns are altered in patients with moderate knee osteoarthritis during gait retraining designed to reduce the knee adduction moment. Podium presentation at ESMAC 2016. Gait & Posture 49. DOI: 10.1016/j.gaitpost.2016.07.132

Dzialo CM., Mannisi M., Marra MA., **Richards R.**, Telfer S., Woodburn J., de Zee M., Andersen MS. A subject-specific analysis framework to investigate gait alterations. Poster presentation at OARSI 2016. Osteoarthritis and Cartilage 24(1):S126 DOI: 10.1016/j.joca.2016.01.247

Barbareschi G., **Richards R.**, Holloway C., Carlson T., Thornton M. Statically vs dynamically balanced gait: Analysis of a robotic exoskeleton compared with a human. Presented at 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS). DOI: 10.1109/EMBC.2015.7319937

Thornton MJ., **Richards R.**, Delaney RMR. Highlighting subtle changes in gait – A new scoring system. Poster presentation at ESMAC 2014. Gait & Posture DOI: 10.1016/j.gaitpost.2014.04.037

National Conferences

Richards R., van der Esch M., Booij MJ., van den Noort J., Harlaar J. Aanpassing van het looppatroon bij mensen met knieartrose: wat weten we over het proces van motorisch leren? Poster presentation at the Dag voor de Fysiotherapeut 2017.

Richards R., van den Noort JC., Booij MJ., van der Esch M., Harlaar J. Real-time feedback for gait retraining in knee osteoarthritis; responses to different types of feedback and instructions. Poster presentation at the Nederlandse Vereniging voor Reumatologie Research day 2016.

Richards R., van den Noort JC., Dekker J., Harlaar J. Systematic Review and Meta-analysis: Use of biofeedback in gait training for knee osteoarthritis patients. Podium presentation at The Vereniging voor Bewegingswetenschappen Nederland PhD day 2015.

Courses Attended

Knee Osteoarthritis disease burden and the epidemiology of Osteoarthritis. VU Universiteit, Amsterdam, Netherlands, March 2015.

Professional training, innovation and enterprise outreach. Glasgow Caledonian University, Glasgow, UK, Aug 2015.

Knee Joint Biomechanics and Anatomy. Munster University, Munster, Germany March 2016.

Musculoskeletal modelling by multi-body dynamics with a focus on the knee joint. Aalborg University, Aalborg, Denmark Sept 2016.

Non-pharmacological interventions for knee osteoarthritis. University of Southern Denmark, Odense, Denmark, March 2017.

Imaging in Knee Osteoarthritis, Paracelsus Medical Private University, Salzburg, Austria, Dec 2017.

Nederlands als Tweede Taal (Dutch as second language) Levels A0-C1, VU Universiteit, Amsterdam, Netherlands, March 2015 to Jan 2018.

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